Docket No.: GR98P2124P

MAIL STOP: APPEAL BRIEF-PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before the Board of Patent Appeals and Interferences

Applic. No.	:	09/761,240	Confirmation No.: 5138
Inventor	:	Josef-Georg Bauer, et al.	
Filed	:	January 17, 2001	
Title	:	Power Semiconductor Element with an Emitter Region and a Stop Zone in Front of the Emitter Region	
TC/A.U.	:	3663	
Examiner	:	Johannes P. Mondt	
Customer No.	:	24131	

Hon. Commissioner for Patents
Alexandria, VA 22313-1450

BRIEF ON APPEAL

S i r :

This is an appeal from the final rejection in the Office action dated August 21, 2008, finally rejecting claims 9 and 10.

Appellants submit this *Brief on Appeal* including payment in the amount of $540.00 to cover the fee for filing the *Brief on Appeal*.

Real Party in Interest:

This application is assigned to Infineon Technologies AG of Germany. The assignment was filed on November 29, 2007.

Related Appeals and Interferences:

No related appeals or interference proceedings are currently pending which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims:

Claims 9 and 10 are rejected and are under appeal. Claims 1 – 8 have been canceled.

Status of Amendments:

No claims were amended after the final Office action.

Summary of the Claimed Subject Matter:

The subject matter of each independent claim is described in the specification of the instant application. Examples explaining the subject matter defined in each of the independent claims, referring to the specification by page and line numbers, and to the drawings, are given below.

Independent claim 9:

A power semiconductor element **[1 of Fig. 1; page 1, lines 13 – 16]**, comprising:

an emitter region **[5 of Fig. 1; page 6, lines 6 – 7]**; and

a stop zone in front of said emitter region **[6 of Fig. 1; page 6, lines 7 – 10]**, the stop zone and said emitter region having mutually opposite conductivities **[page 3, lines 7 – 8]**, the stop zone including sulfur atoms **[page 4, lines 11 – 12; page 6, lines 20 - 22]** with at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor **[page 6, lines 17 – 22]**, the stop zone having a doping profile of sulfur atoms such that the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region **[8, 9 of Fig. 2; page 7, lines 10 – 19]**.

Independent claim 10:

A power semiconductor element **[1 of Fig. 1; page 1, lines 13 – 16]**, comprising:

an emitter region **[5 of Fig. 1; page 6, lines 6 – 7]**; and

a stop zone in front of said emitter region **[6 of Fig. 1; page 6, lines 7 – 10]**, the stop zone and said emitter region having mutually opposite conductivities **[page 3, lines 7 – 8]**, the stop zone including selenium atoms **[page 4, lines 11 – 12; page 7, lines 21 - 23]** with at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor **[page 7, line 23 – page 8, line 2]**, the stop zone having a doping profile of selenium atoms such that the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region **[8, 9 of Fig. 2; page 7, lines 10 – 19; page 8, lines 4 – 18]**.

Grounds of Rejection to be Reviewed on Appeal

1. Whether or not claims 9 and 10 are obvious over Schulze (5,610,415) in view of Rosling et al. (IEEE Transactions on Power Electronics, Vol. 9, No. 5, September 1994, pages 514 – 521) under 35 U.S.C. § 103.

Argument:

I. Appellants' claims 9 and 10 are not obvious over the prior art cited in the final Office Action, whether taken alone or in combination.

In item 1 of the final Office Action dated August 21, 2008 (the "final Office Action"), claims 9 and 10 were rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U. S. Patent No. 5,610,415 to Schulze ("**SCHULZE**"), in view of Rosling et al., "A Study of Design Influence on Anode-Shorted GTO Thyristor Turn-On and Turn-Off", IEEE Transactions on Power Electronics, Vol. 9, No. 5, September 1994, pages 514 - 521 ("**ROSLING**").

Appellants respectfully traverse the above rejections.

A. The Prior Art fails to teach, suggest or even recognize any advantage to, among other limitations of Appellants' claims, doping with sulfur or selenium atoms having at least one energy level within the band gap of the semi-conductor at least 200meV away from both of the conduction and valance bands of the semiconductor, as required by Appellants' claims 9 and 10.

More particularly, Appellants' claim 9 recites, among other limitations:

an emitter region; and

> a stop zone in front of said emitter region, the stop zone and said emitter region having mutually opposite conductivities, **the stop zone including <u>sulfur</u> atoms with at least one energy level within the band gap of the semiconductor and at least <u>200 meV</u> away from <u>both</u> a conduction band and a valence band of the semiconductor**, the stop zone having a doping profile of sulfur atoms such that **the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region**. [emphasis added by Appellants]

Similarly, Appellants' claim 10 recites, among other limitations:

> an emitter region; and
>
> a stop zone in front of said emitter region, the stop zone and said emitter region having mutually opposite conductivities, **the stop zone including <u>selenium</u> atoms with at least one energy level within the band gap of the semiconductor and at least <u>200 meV</u> away from <u>both</u> a conduction band and a valence band of the semiconductor**, the stop zone having a doping profile of selenium atoms such that **the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region**. [emphasis added by Appellants]

Thus, Appellants' claim 9 requires, among other limitations, an emitter region and a stop zone in front of the emitter region, the stop zone including **<u>sulfur</u>** atoms **with at least one energy level within the band gap of the semiconductor and <u>at least 200 meV</u> away from <u>both</u> a conduction band and a valence band of the semiconductor**. Similarly, Appellants' claim 10 requires, among other limitations, an emitter region and a stop zone in front of the emitter region, the stop zone including **<u>selenium</u>** atoms **with at least one energy level within the band gap of the semiconductor and <u>at least 200 meV</u> away from <u>both</u> a conduction band and a valence band of the semiconductor**. Additionally, Appellants' claims 9 and 10 require, among other limitations, that the claimed stop zone be doped with the sulfur (claim 9) or selenium (claim 10) atoms **such that the stop zone is only**

partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region.

However, neither the **SCHULZE** reference, nor the **ROSLING** reference, teach or suggest, alone or in combination, a power semiconductor element including an emitter region and a stop zone in front of the emitter region, the stop zone including **sulfur** (claim 9) or **selenium** (claim 10) atoms **with at least one energy level within the band gap of the semiconductor and <u>at least 200 meV</u> away from <u>both</u> a conduction band and a valence band of the semiconductor**, the stop zone having a doping profile of **sulfur** (claim 9) or **selenium** (claim 10) atoms **such that the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region**, among other limitations of Appellants' claims.

The final Office Action actually acknowledges the failure of the **SCHULZE** and **ROSLING** references to teach or suggest Applicants' particularly claimed stop zone **including foreign doping atoms having at least one energy level within the band gap of the semiconductor and <u>at least 200 meV</u> away from <u>both</u> a conduction band and a valence band of the semiconductor**. See, for example, page 3 of the final Office Action, lines 4 – 8, stating:

> Schulze does not explicitly teach the limitation that said foreign atoms are either sulfur atoms or selenium atoms, **on account of which they have at least one energy level within the band gap of the semiconductor and at least 200 meV away from both valence and conduction band of said semiconductor**, being silent on the material embodiment of the semiconductor in explicit terms. [emphasis added by Appellants]

See also, for example, page 3 of the final Office Action, line 20 – page 4, line 9, states:

> Furthermore, **although neither Schulze nor Rossling necessarily teach the specific selection of either sulfur or selenium for said atoms** Applicant is reminded that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416. Combination of the teaching by Rosling et al with the invention by Schulze immediately satisfies said limitation because gold (as acceptor (A): 290 meV), barium (as donor (D): 320 meV), cesium (as donor (D): 300 meV), molybdenum (300 meV), nickel (as acceptor (A) 350 meV) have at least one energy level within the band gap of silicon and 200 meV away from both the conduction band and valence band of silicon, as witnessed by the collected and evaluated data in Sze as made of record 5/15/02, page 21, Figure 13. [emphasis added by Appellants]

Rather, as can be seen from the foregoing cited portions of the final Office Action, the final Office Action alleges that Appellants' selection of the particularly recited chosing sulfur atoms (claim 9) or selenium atoms (claim 10) are the **"mere selection of known materials"** that would allegedly be "entirely obvious" to a person of ordinary skill in this art. Appellants respectfully disagree.

More particularly, the **SCHULZE** and **ROSLING** completely **<u>fail</u>** to teach or suggest, among other things, any **<u>recognition</u>** of an advantage **<u>to including foreign atoms</u> having at least one energy level within the band gap of the semi-conductor which is at least 200meV away from both the conduction and valance bands of the semiconductor**, as claimed by Appellants. Absent such a recognition of an advantage to a doping atom meeting the particularly claimed criteria, a person of ordinary skill in this art would not be provided with any teaching or suggestion to

select sulfur or selenium atoms to satisfy a particularly claimed criteria (i.e., "200meV ....") that they know nothing about.

In other words, in light of this failure in the teachings and understandings of **SCHULZE** and **ROSLING**, a person of ordinary skill in the art would not have any understanding of the advantages supplied by Appellants' claimed materials satisfying the particular criteria, nor would they have any teaching, suggestion or motivation to even look for a dopant species that satisfies these criteria. Whereas, the mere selection of known materials generally understood to be suitable to make a device would likely be obvious, as alleged, that is not the case with the present invention. Rather, in the present case, the selection of sulfur or selenium would not be generally understood as being suitable to make the claimed device, because a person of ordinary skill in this art would simply **<u>not</u>** know that he can obtain any advantage by selecting a dopant species having at least one energy level within the band gap of the semi-conductor and at least 200meV away from both the conduction and valance bands of the semiconductor.

MPEP § 2144.07 addresses the obviousness of the selection of a known material based on its suitability for its intended purpose, **when that suitability <u>is</u> <u>recognized</u> <u>in the art</u>**. More particularly, MPEP 2144.07 is entitled "**<u>Art Recognized</u>** Suitability for an Intended Purpose" and cites to, among other cases, *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). MPEP § 2144.07 discusses the holding in *Sinclair & Carroll Co. v. Interchemical Corp.*, stating:

> Claims to a printing ink comprising a solvent having the vapor pressure characteristics of butyl carbitol so that the ink would not dry at room temperature but would dry quickly upon heating were held invalid over a reference teaching a printing ink made with a different solvent that was nonvolatile at room temperature but highly volatile when heated **in view of an article which taught the desired boiling point and vapor pressure characteristics of a solvent for printing inks** and a catalog teaching the boiling point and vapor pressure characteristics of butyl carbitol. "**Reading a list and selecting a known compound** to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig-saw puzzle." 325 U.S. at 335, 65 USPQ at 301. [emphasis added by Appellants]

As can be seen by the foregoing, there was clearly an "art recognized suitability" in *Sinclair & Carroll Co. v. Interchemical Corp.*, **because the cited art explicitly taught the claimed characterisitics** (i.e., "an article **which taught** . . .", "**Reading a list** and selecting a known compound . . ."). Similarly, *In re Leshin,* is mentioned in MPEP 2144.07 affirming the obviousness of the selection **of a known plastic** to make a container **of a type made of plastics** prior to the invention. Although there is no mention in MPEP 2144.07 of art recognizing the particular plastics as suitable for use in manufacturing lipstick containers, it seems likely that it was **generally recognized that the chosen plastics would be suitable for such a use**.

However, the **SCHULZE** and **ROSLING** references **fail to recognize any suitability of doping atoms having at least one energy level within the band gap of the semi-conductor and at least 200meV away from both the conduction and valance bands of the semiconductor**, as required by Appellants' claims. Thus, **SCHULZE** and **ROSLING** fail to provide any recognition of any particular or general suitability of using sulfur or selenium atoms, which atoms meet Appellants' particularly recited criteria.

Whereas item 2b of the final Office Action cites to MPEP 2144.07 for support of its obviousness rejection, M.P.E.P. § 2144.07 simply does **not** apply to the present claims, i.e., to the selection of Sulfur or Selenium *fulfilling the particular criteria* of Appellants' claims. Both the language of M.P.E.P. § 2144.07, and the cases cited to therein, require an explicitly taught recognition of the advantages of the claimed characteristics, thus making a generally known substitution apparent to a person of skill in the art. However, this is contrary to the present case, wherein the advantages provided by Appellants' particularly claimed materials are not taught by, recognized in or derivable from, the cited prior art.

In particular, in the absence of any recognition or acknowledgement in **SCHULZE** or **ROSLING** of the advantages of selecting a foreign atom having at least one energy level within the band gap of the semi-conductor and at least 200meV away from both the conduction and valance bands of the semiconductor, Appellants believe that use of sulfur or selenium, as in the instant invention, would not have been obvious over **SCHULZE** or **ROSLING** at the time that the invention was made. Rather, at the time of the invention, the person of ordinary skill in this art did **not** know to select an atomic species with at least one energy level within the band gap of the semiconductor and at least 200 meV away from the conduction band and valance band of the semiconductor, to provide a stop zone functioning as claimed by Appellants. This information only became part of the general knowledge **as a result of the present patent application and its parent applications**. Without this general knowledge, provided by the instant application, the person of ordinary skill in the art, at the time that the present invention was made, did **not** know or realize that materials satisfying Appellants' claimed criteria,

provide advantages to solve the technological problem to which the instant application is directed.

Further, page 4 of the final Office Action alleged, in part, that the general disclosure in **SCHULZE** of using gold, barium, cesium molybdenum, or nickel as possible materials (the Examiner noting that those materials have at least one energy level within the band gap of silicon, but **not** that it is at least 200 meV away from both of the conduction band and valance band of the semiconductor) would render obvious the selection of selenium or sulfur. Appellants respectfully disagree.

More particularly, the disclosure in **SCHULZE** would **only** permit a person of ordinary skill in this art to understand that he may use cesium, niobium, molybdenum and barium when the second emitter zone is p-doped, because of the particular recitation in col. 2 of **SCHULZE**, lines 11-13, teaching the use of these particular materials **because they exhibit specific other desired properties**. See, for example, col. 2 of **SCHULZE**, lines 11 – 16, stating:

> For the standard case where the second emitter zone is p-doped, **these additional substances must thus have donor properties at 300° C**. Molybdenum, niobium, cesium or barium, for example, come into consideration as additional substances having such donor properties. [emphasis added by Appellants]

Thus, a person of ordinary skill in this art, upon reading **SCHULZE**, knows only that he may use cesium, niobium, molybdenum and barium when the second emitter zone is p-doped, because these materials have donor properties at 300° C, per **SCHULZE**. Further, as can be seen from the foregoing, **SCHULZE** specifically teaches a person of ordinary skill in the art to choose a particular atomic species,

not based on its many other properties, but rather, based only on whether they would be donor materials above a certain temperature.

In view of the foregoing, Appellants believe that the **SCHULZE** and **ROSLING** references cited in the final Office Action would **not** teach, suggest or motivate a person of ordinary skill in this art to derive the invention of Appellants' claims 9 and 10, and the specific properties of the particularly selected materials that provide the advantageous subject matter therein. Rather, Appellants' claims require the selection of doping atoms having at least one energy level within the band gap of the semi-conductor and at least 200meV **away from both the conduction and valance bands of the semiconductor.** Before there can be a "substitution" of dopant atoms having generally known suitability for an intended purpose (i.e., sulfur in place of gold, as alleged in the final Office Action), there **must** first be a recognition of the intended purpose (i.e., an energy level at least 200 meV away from both of the conduction band and valance band of the semiconductor). In the absence of the realization made by Appellants' relating the particularly claimed material properties to the advantageous nature (i.e., intended purpose) of the invention, a person of ordinary skill in this art would **not** substitute sulfur or selenium into the semiconductor device of **SCHULZE**.

As the prior art fails to teach, suggest or recognize, among other limitations of Appellants' claims, the suitability selecting doping atoms with at least one energy level in the band-gap **and at least 200meV away from both the conduction and valance bands of the semiconductor**, Appellants' claimed invention would not be obvious from **SCHULZE** taken in combination with **ROSLING**.

B. The Prior Art fails to teach or suggest, and even teaches away from, among other limitations of Appellants' claims, doping with sulfur or selenium atoms, as required by Appellants' claims 9 and 10.

Further, even if, **arguendo**, it could be assumed that a person of ordinary skill in this art were somehow motivated to try to combine the teachings of **SCHULZE** and **ROSLING** in the manner suggested in the final Office Action, the combination would **not** produce the invention of Appellants' claims 9 or claim 10. First, as stated above, neither **SCHULZE,** nor **ROSLING,** specifically teach or suggest the use of either sulfur atoms or selenium atoms as foreign doping atoms in the semiconductor materials. Similarly, neither **SCHULZE,** nor **ROSLING,** suggest the inclusion of an atomic species with energy level within the band gap of the semiconductor and at least 200 meV away from **both** a conduction band and a valance band of the semiconductor. Further still, neither **SCHULZE**, nor **ROSLING,** teach or suggest **a particular doping profile** of sulfur or selenium atoms, thus failing to provide any teaching, suggestion or motivation for a doping profile of sulfur or selenium atoms such that the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region, as required by Appellants' claims.

In fact the person of ordinary skill in the art must do more than merely combine the teachings of **Rosling** with **Schulze,** to obtain the subject matter of Appellants' claims 9 and 10, as such a combination fails to provide the above-discussed limitations of Appellants' claimed invention, among others. However, a person of ordinary skill in this art would not otherwise derive the limitations of Appellants'

claims missing from **Rosling** and **Schulze**, for at least the following reasons, among others.

First, the substitution of sulfur or selenium atoms into the device of **SCHULZE** would impermissibly destroy that device for its intended purpose. See, for example, M.P.E.P. § 2143.01(V). Rather, sulfur or selenium doping atoms are **not** suitable for use in the device of **SCHULZE**.

More particularly, the disclosure of **SCHULZE** teaches that damage can be prevented to the disclosed device by a strong local reduction of the emitter efficiency at temperatures above the operating temperature by doping with substances that act as dopants of the first conductivity type above the operating temperature but which are only slightly electrically active at normal operating temperature. See, for example, col. 2 of **SCHULZE**, lines 7 - 11. When the emitter is p-doped, **SCHULZE** specifically teaches the use of cesium, niobium, molybdenum and barium doping atoms. See, for example, col. 2 of **SCHULZE**, line 14. Additionally, when the emitter is n-doped, **SCHULZE** specifically teaches the use of cadmium, zinc, gold or nickel doping atoms. See, for example, col. 2 of **SCHULZE,** line 19. All of these substances, suggested in **SCHULZE,** partially or entirely compensate the doping of the emitter zone above the operating temperature. See, for example, col. 2 of **SCHULZE**, lines 21-29.

But further, **SCHULZE** teaches that for **complete** compensation to occur, the doping concentration should be **as high as that of the standard dopants.** See, for example, col. 2 of **SCHULZE**, lines 27 – 29, read in combination with col. 2 of

SCHULZE, lines 5-7. However, both sulfur and selenium have a solid solubility in silicon (i.e., the standard semiconductor material, and the only semiconductor taught in **ROSLING)** that is whole orders of magnitude lower than the solid solubility of the standard dopants in silicon (i.e., boron or phosphorus).

Specifically, selenium and sulfur have a solid solubility in silicon in the range of 10^{16} to 10^{17} atoms/cm^3, compared to the solid solubility of boron in silicon which is of the order of 10^{20} atoms/cm^3. Thus a person of ordinary skill in the art, knowing this and reading **SCHULZE,** would not even consider the use of either selenium or sulfur for inclusion in the semiconductor device of **SCHULZE,** because use of sulfur or selenium would prevent achieving the correct concentration of these substances, as taught by **SCHULZE.**

Further still, Appellants believe that, by teaching a doping concentration for the additional substances which is **at least as high** as the doping concentration of the standard dopants, **SCHULZE** effectively **<u>teaches away</u> from using substances such as sulfur or selenium**. Without the doping concentrations being approximately the same, as taught by **SCHULZE**, the device of **SCHULZE** may be unable to meet the disclosed goal of preventing damage to the device, since the local reduction of emitter efficiency at temperatures above the normal operating temperature may not be strong enough to prevent such damage.

Thus, a person of ordinary skill in the art, reading **SCHULZE,** would be taught that any device in which the concentration of the traditional dopants is not balanced by the concentration of the additional dopants carries a risk of failure, as taught by

SCHULZE. Thus, the substitution of sulfur or selenium atoms into the device of **SCHULZE** would impermissibly destroy that device for its intended purpose under M.P.E.P. § 2143.01(V).

As such, even if the person of ordinary skill in the art were to attempt to construct devices outside the explicit disclosure of **SCHULZE,** he would construct devices in which the additional dopants could be included in the semiconductor at a similar concentration as the standard dopants (i.e., boron or phosphorus), and thus, using the teachings of **SCHULZE**, at the concentrations achievable using cesium, niobium, molybdenum, barium or by using cadmium, zinc, gold or nickel. However, in view of the teachings of **SCHULZE,** a person of ordinary skill in the art would not consider using an atomic species with a solid solubility in the semiconductor that is whole orders of magnitude lower than taught in **SCHULZE**. Thus, in view of the teachings of **SCHULZE**, a person of ordinary skill in this art would not chose to use either sulfur or selenium in the device of **SCHULZE**.

Further still, the person of ordinary skill in the art, if he were to consider alternatives to the dopants listed in **SCHULZE**, he would consider atomic species of a similar type and similar electronic properties. All the atomic species cited by **SCHULZE** are metals, being either group 1 or 2 metals or transition metals. In fact the two groups of additional dopants proposed by **SCHULZE** are placed remarkably close together within the periodic table being either clustered together in and towards the metal end of the periodic table, in the case of cesium, niobium, molybdenum and barium, or clustered together in groups 10, 11 and 12 of the transition metals, in the case of cadmium, zinc, gold and nickel. It is known in the art that the individual

properties of atomic species within the transition metals vary considerably, even from species to species in the table. However, despite this, it is most probable that a person of ordinary skill in this art, when considering alternatives to the atomic species listed in **SCHULZE**, would consider substances i**n the same vicinity of the periodic table**, as those listed in **SCHULZE**. As such, a person of ordinary skill in the art would certainly **<u>not</u>** consider replacing the metals suggested in **SCHULZE** with a substance from a non-metal group of the periodic table, such as sulfur or selenium, and nothing in **SCHULZE** would cause him to do so.

For the foregoing reasons, among others, it can be seen that a person of ordinary skill in the art, reading the **SCHULZE** and **ROSLING** references, would not be able to derive Appellants' claimed invention, and, in fact, would taught away from Appellants' claimed invention.

II. Conclusion.

For the foregoing reasons, among others, Appellants' claims are novel and unobvious over the **SCHULZE** and **ROSLING** references, whether taken alone or in combination.

The honorable Board is therefore respectfully urged to reverse the final rejection of the Primary Examiner.

If an extension of time is required for this submission, petition for extension is herewith made. Any fees due should be charged to Deposit Account No. 12-1099 of Lerner Greenberg Stemer LLP.

Respectfully submitted,

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Claims Appendix:

9. A power semiconductor element, comprising:

an emitter region; and

a stop zone in front of said emitter region, the stop zone and said emitter region having mutually opposite conductivities, the stop zone including sulfur atoms with at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor, the stop zone having a doping profile of sulfur atoms such that the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region.

10. A power semiconductor element, comprising:

an emitter region; and

a stop zone in front of said emitter region, the stop zone and said emitter region having mutually opposite conductivities, the stop zone including selenium atoms with at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor, the stop zone having a doping profile of selenium atoms such that the stop zone is only partially electrically active in the on-state and fully electrically active in the off-state for carriers emitted by the emitter region.

Evidence Appendix:

No evidence pursuant to §§ 1.130, 1.131, or 1.132 or any other evidence has been entered by the Examiner and relied upon by appellant in the appeal.

Related Proceedings Appendix:

No prior or pending appeals, interferences or judicial proceedings are in existence which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal. Accordingly, no copies of decisions rendered by a court or the Board are available.